SAFETY MANAGEMENT

Charles Seaton

John Tomblin

Wichita State University

ABSTRACT

FAA composite safety and certification initiatives work with all sectors of the industry in order to ensure the safe and efficient deployment of composite technologies used in existing and future aircraft. This paper focuses on knowledge transfer, training and global industry collaborations as initiatives for promoting the safe use of composites in commercial aviation.

1. INTRODUCTION

1.1 Strategies

Essential to proactively promoting the safe use of composites is the involvement of all sectors of industry in the development of standard practices through material properties and education development. Groups dedicated to promoting standard practices include the Commercial Aircraft Composite Repair Committee (CACRC), CMH-17, ASTM, and other similar organizations.

1.2 Approach

Transferring technology knowledge databases, handbooks, manuals, industry practices, practical insights, and training are essential to improving safety management and the promotion of standard industry practice in commercial aviation.

Technology transfer methodologies for communicating initiatives depend primarily on reports and workshops. Other means of communication are listed below in the order of increasing use frequency. Note that education courses are the least used with regard to technology transfer in the current environment. This conclusion is based on experience by the Federal Aviation Administration, but feedback has suggested that the same conclusion could be reached throughout the composites industry.

1. Education courses (case studies, subject matter experts, and on-line, classroom, tutorials, labs teaching formats)

2. Internships (industry, faculty and student coops)

3. Composite handbooks with guidelines and standards
4. Workshops on current industry practice
5. Technical research reports and related journal articles

The focus of this paper is on knowledge transfer through education and the role of case studies for identifying safety issues and providing teaching resources for learning organizations.

2. Safety Management Initiatives

Two groups which promote the development of standards include CACRC and CMH-17. Within the CACRC the training and airworthiness task groups relate specifically to workforce practices. The training task group has published teaching points for the composites maintenance training course developed through AMTAS (AIR 5719), and has received executive approval for a new AIR document which will be a compilation of case studies that will be available to industry. CMH-17 (formerly MIL HDBK 17) offers one-day tutorials based on certification and statistics, held in conjunction with workshops which are held on an 8-month cycle.

An online composites maintenance technology (CMT) course is currently being offered through the National Center for Aviation Training (NCAT, Wichita, KS), using online teaching resources through NIAR/WSU and with college credit available through Wichita Area Technical College. A unique advantage of this awareness course is the remote involvement of experts in the discussion boards.

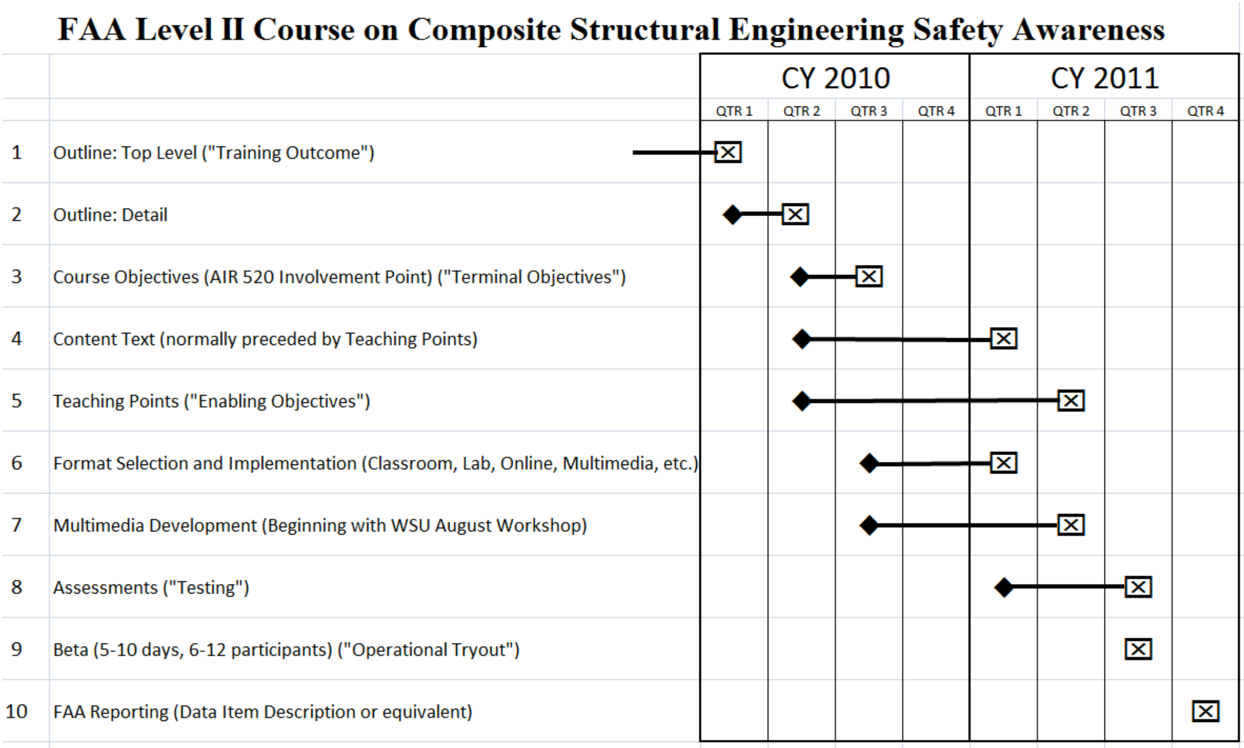
Case studies, particularly those associated with extensive repairs, are being prepared in conjunction with industry to identify specific practices which result in non-approved repairs. These case studies are being used in the CMT course, a chapter on a new chapter in CMH-17 related to safety management, and will be published through the CACRC as a new information report document.

One outcome of the above initiatives relates to the identification and potential for further short course development.

3. AIRCRAFT CERTIFICATION OFFICE (ACO) COURSE DEVELOPMENT

A course is being developed which will provide ACO engineers with the essential safety issues and technology concerning the use, manufacture, certification, and continued airworthiness of composites in aircraft structures. As currently envisioned, the course will be a combination of online delivery supplemented with a hands-on laboratory which will reinforce learning principles. The course will be at an awareness course, or ‘level II’, and involve subject matter experts in the online discussion boards. A detailed outline has been developed, and a workshop for a portion of the course will be given in September 2010 by NIAR and Wichita State University.

The development schedule is as follows:



1. OTHER KNOWLEDGE TRANSFER ACTIVITIES

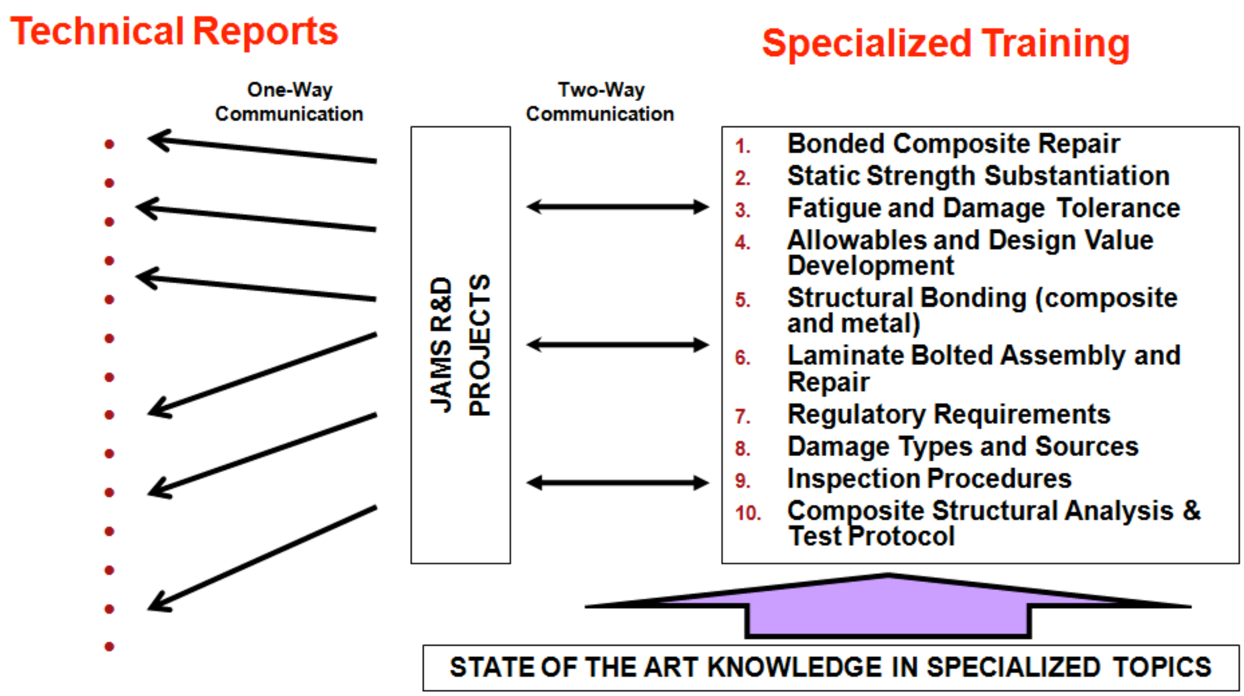
Two courses are currently being offered: Composites Maintenance Technology (CMT) and Certification of Composite Aircraft (CMH-17 tutorial)

The CMT course was developed through JAMS between 2004 and 2007, and adapted for the FAA inspectors in 2008. It is being offered through NCAT utilizing education resources at NIAR and Wichita State University. The course requires eight weeks and focuses on the safety issues involved in composites maintenance, including the importance of roles and responsibilities, source documentation, disposition and repair, damage types and inspection procedures, and repair processes. Much of the learning comes from discussions involving both case studies and subject matter experts from industry, which makes this course unique. Development under consideration for this course is compressing it to six weeks.

Certification of Composite Aircraft tutorial is provided over a 6-hour period during CMH-17 workshops. Several experts team teach the course, and damage tolerance is an emphasis in the content. Future developments being considered are to create content which can be taken on-line, and reserving the on-site learning experience for interacting with experts during CMH-17 workshops.

2. TECHNICAL REPORTS AND SPECIALIZED TRAINING: ONE MODEL

Following the completion of research and development activities by JAMS, a technical center report is typically produced for the FAA. This process could be enhanced by the participation in JAMS schools in specialized training which has been formerly reported as an outcome of designated engineering representative surveys taken during required recurrent training. By integrating R&D with specialized training, the projects are subjected to two-way communication during the project phase, increasing the opportunity for industry input into the research process. This is illustrated by the following:



3. CASE STUDIES

Airlines are becoming more dependent on outside organizations for maintaining, and repairing, aircraft. The potential for unapproved repairs, especially in the instance of extensive repair 'build-ups', has indicated a need to document prior practices which might lead to incorrect repairs. The objective of case studies, therefore, is to identify safety themes common to various situations, and to provide a case study format which is conducive to teaching.

Several case studies have indicated a need for awareness training at various levels in repair organizations. Examples supporting this conclusion and leading to unapproved repairs include:

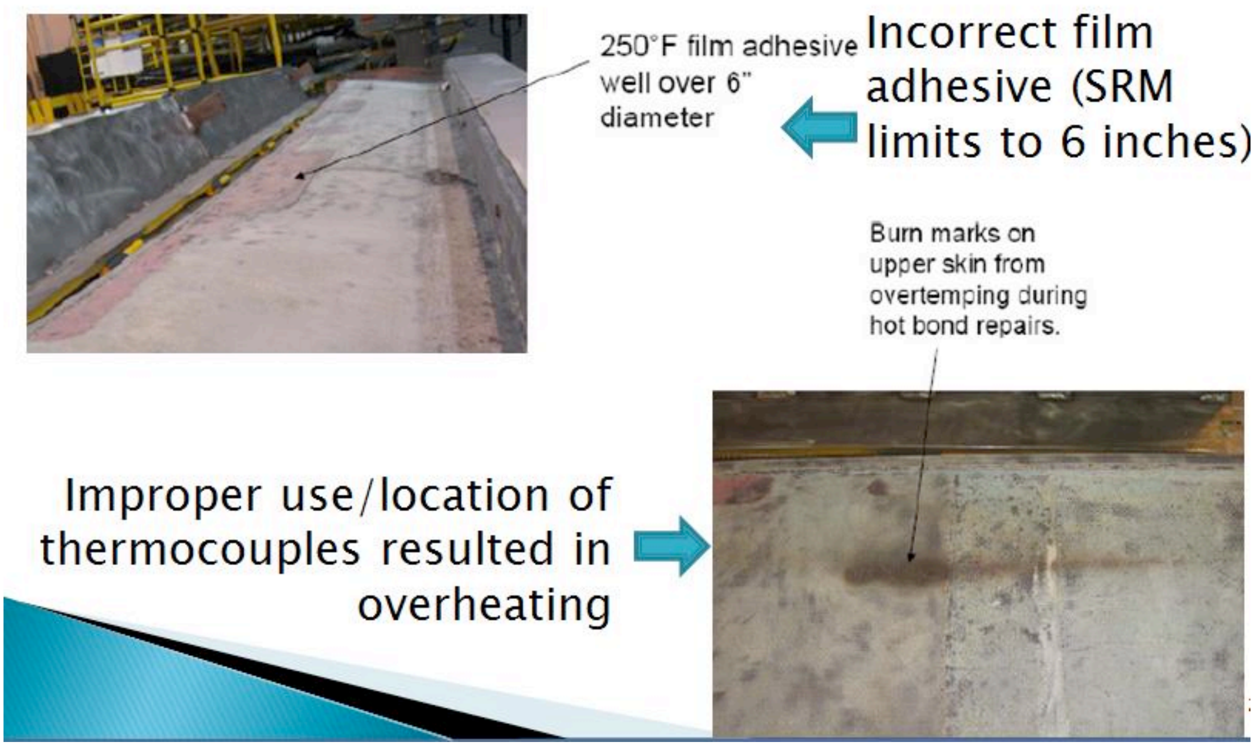
1. Too much reliance on process without understanding technology

2. Instances of working outside SRM without approvals

3. Lack of understanding the limitations of nondestructive testing

4. Understanding the importance of proper process controls

A transport flap was the subject of one such case study. After a repaired flap was returned to an airline, it was determined that the flap could not be properly fit to the aircraft due to a considerable warp in the part. The flap was torn down to determine the cause of the discrepancy, and several issues were identified:



For education purposes, several discussion points resulted from this incident as follows:

- **Roles and Responsibilities**
  - What can be the result of repairs made which are a) outside the limitations of the SRM and b) not properly substantiated? (e.g. unapproved and unsubstantiated repair)
- **Configuration Control**
  - How could the improper repairs have been detected aside from the lack of fit and function of the part on the aircraft? (e.g. proper tooling and a check fixture)
- **Process Control**
  - Describe how the various prior repair discrepancies could have been prevented by proper process control during and after the repairs. (e.g. worksheet checklist with inspector sign-off after each repair step)

4. SAFE COMPOSITES PRACTICE

The specific challenges to the effective knowledge transfer of technology and awareness of safety involve overcoming weak incentives for practitioners to take awareness courses. Without mandatory and specific training requirements, it is clear that "those who know the least are less likely to see value of awareness education". In the recent online CMT course, 100% of the students were engineers who, through their work experience and knowledge of composites in certain areas, saw value in dedicating time and resources to awareness education. Significantly there were no inspectors, technicians or managers who interface with composites in course attendance.

Case studies support the need to create short courses for practitioners – much of the safety issues identified are directly traceable to inadequate knowledge and training. Practitioners ought to be exposed to the practical aspects of safety when working with composite materials, including fundamental issues identified through case studies which can be used in the education process. These courses should be focused, short, inexpensive, and accessible. Learning is best retained when a 'meaning before content' learning environment is utilized. Much of the content for these short courses could be extracted from the CMT course which was developed with considerable industry involvement.

Examples of short course topics should have immediate benefits to student audiences:

1. Airline/operator training for auditing MRO facilities, including 'checklist' based on FSDO course development (2008)
2. Ramp safety practice for airlines
3. Quality control for composite materials (calibration, time in/out logs, etc.)
4. Tailored topics for general aviation (Cessna or Beech service centers)

5. A LOOK FORWARD

Future initiatives will benefit aviation by improving safe composites practice through education and the promotion of standards. Some specific directions might include:

1. Continue broad awareness course developments beyond existing offerings
2. Expand awareness courses to short topics having immediate benefit to student audience
3. Encourage global access to (anonymous) case studies to identify safety issues and provide education materials. Case studies and training objective development for future courses are closely linked.